

DETAILED ACTION

Status of Application

Claims 2-12, 14, 16, 17, and 20-22 are pending and presented for examination.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/22/2010 has been entered.

Response to Arguments

Applicant's arguments with respect to claims 2-12, 14, 16, 17, and 20-22 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 2-12, 14, 16, 17, and 20-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Independent claims 2 and 8 require immobilizing the

biomolecules on the surface of a silicon semiconductor, but also require them to be immobilized on the surface of the layer of hydrophobic polymer. It does not appear that the biomolecule can be immobilized directly on the surface of the silicon semiconductor and on the layer of hydrophobic polymer. The examiner has interpreted the claim as immobilizing the biomolecules on a silicon semiconductor (rather than on the surface of the semiconductor).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 2, 3, 5, 7, 8, 10, 11, 16, 17, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Keefe (U.S. PG PUB No. 2002/0004204) in view of Vo-Dinh ("Development of a DNA biochip: Principle and Applications").

Regarding claims 2, 3, 5, 7, 8, 10, 11, 16, 17, 21 and 22, O'Keefe teaches a method comprising attaching DNA to a substrate surface by spotting the DNA on the substrate surface (0060). O'Keefe teaches that the substrate can comprise a silicon semiconductor (0058), which presents a planar surface (0056) and includes a plurality of photodiodes (0007 and 0070-0073). O'Keefe further teaches that this substrate may have a polymer applied in defined regions to its surface prior to DNA functionalization (0064). O'Keefe fails to teach the polymer layer being a hydrophobic polymer as claimed, covalently immobilizing molecules with UV light, the surface of the polymer utilized in application with an integrated circuit, or the photodiodes being CMOS photodiodes.

However, Vo-Dinh teaches a similar process comprising immobilizing DNA on a polymer layer for application to a semiconductor that includes a plurality of CMOS photodiodes (abstract, section 2.1, page 53 and section 2.3, page 53-54) comprising: applying a layer of hydrophobic, non-swelling polymer, such as polystyrene or nitrocellulose, to an integrated circuit semiconductor (2nd paragraph of section 2.3, page 54 and section 3.1, page 55); and immobilizing DNA on the surface of the layer of hydrophobic polymer by spotting (3rd

paragraph of section 2.3, page 54) followed by covalently immobilization with the use of UV light (2nd paragraph of section 2.3, page 54). Vo-Dinh teaches applying the polymer layer in defined regions of the semiconductor (2nd paragraph of section 2.3, page 54). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify O'Keefe's process by immobilizing the biomolecule by UV irradiation on a hydrophobic polymer attached to a surface of an integrated circuit comprising a plurality of CMOS photodiodes as disclosed by Vo-Dinh. One would have been motivated to make this modification as immobilizing the biomolecule to the hydrophobic polymer via UV activation would ensure that the biomolecule was firmly attached to the surface and could not be easily detached.

3. Claims 4, 6, 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Keefe in view of Vo-Dinh as applied to claim 8 above, and further in view of Hubbell et al. (U.S. PG PUB No. 2002/0128234).

Regarding claims 4, 6, 12 and 14, O'Keefe in view of Vo-Dinh teach all the limitations of claim 8, but fail to teach activating the polymer layer or imparting a charge to the polymer layer by oxygen plasma treatment. However, Hubbell teaches immobilizing biomolecules on the surface of a polymer that has been applied to the surface of a sensor chip (abstract and Figure 2B). Hubbell further teaches that the polymer may be polystyrene which can be modified by an oxygen plasma, thereby imparting a charge to the polymer surface to make it more amenable to grafting (0014). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify O'Keefe in view of Vo-Dinh's method by treating the polymer

surface with an oxygen plasma to activate it for grafting with the DNA, as taught by Hubbell.

One would have been motivated to make this modification as it would allow for the activation of the polystyrene thereby allowing for rapid functionalization of the polystyrene in the immobilization step.

4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Keefe in view of Vo-Dinh as applied to claim 8 above, and further in view of Kimura et al. (U.S. PGPub No. 2002/0018996).

Regarding claim 9, O'Keefe in view of Vo-Dinh teach all the limitations of claim 8, but fail to teach immobilizing the DNA on a polyimide polymer substrate. However, Kimura teaches that nucleic acids, such as DNA (0025) can be immobilized on polyimide substrates (0032-0035). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify O'Keefe in view of Vo-Dinh's method by utilizing polyimide as the polymer substrate for the DNA immobilization, as taught by Kimura. One would have been motivated to make this modification as it is simply the substitution of one known polymer substrate for DNA for another. Furthermore, one of ordinary skill in the art at the time of the invention could have made this substitution with a reasonable expectation of success (given that Kimura is teaching the immobilization of nucleic acid, such as DNA, on the substrate), and the predictable result of providing a substrate for DNA immobilization to be combined with an integrated circuit.

5. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Keefe in view of Vo-Dinh as applied to claim 17 above, and further in view of Theil (U.S. Pat. No. 6325977).

Regarding claim 20, O'Keefe in view of Vo-Dinh teach all the limitations of claim 17, but fail to teach the inorganic material comprising a semiconducting oxide. However, Theil teaches an integrated circuit having photosensors fabricated utilizing CMOS technology (abstract). Theil further teaches these circuits having a semiconducting oxide layer (column 7, lines 21-28) upon which biomolecules are immobilized (see Figure 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to prepare the polymer layer on a semiconducting oxide layer as taught by Theil. One would have been motivated to make this modification as Theil teaches that this semiconducting oxide layer can help to optimize the amount of light detected by the sensor (column 7, lines 33-35).

Conclusion

Claims 2-12, 14, 16, 17, and 20-22 are pending.

Claims 2-12, 14, 16, 17, and 20-22 are rejected.

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT S. WALTERS JR whose telephone number is (571)270-5351. The examiner can normally be reached on Monday-Thursday, 9:00am to 7:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on (571)272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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